MONITORING OF COMPOSITE MATERIALS AND STRUCTURES FROM CRADLE TO RETIREMENT USING SENSOR TECHNOLOGY

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ABSTRACT

The **assurance** of the performance of composite materials and structures requires NDE monitoring of their integrity at the various stages of the structure life, from manufacturing through service. in the last three decades many NDE methods were developed either by adapting the technology that was widely used for inspection of metals or by specifically addressing the unique characteristics of composites. This development was made in parallel to the application of composites to both flaw critical structures (aircraft wings, fuselage, etc.) and the commercial products (rackets, fishing rods, etc.). In spite of the significant progress that was made, several problem areas are still associated with the application of NDE methods to composites, including the following:

- Process standards are still limited and are not consistent industry wide.
- Need for large-area rapid-scanning techniques.
- Health (in-proms and in-service) monitoring techniques.
- Residual Stress measurement techniques.

The cost and the risk associate with detection of flaws at a progressive stage can be very high. While in metals, an inspection schedule can be acceptable due to the ability to accurately predict flaw growth, the risk and the random nature of impact damage requires more often inspection. Further, the detection of flaws during production allows to take corrective measure and thus save significantly in cost of manufacturing.

The use of remote interrogation of test structures is rapidly gaining interest as the development of both laser based NDE methods and sensors are growing Some of these NDE methods are covered by other speakers including shearography and laser ultrasonics as well as the use of embedded optical-fiber. The emphasis of this presentation will be on the application of sensors for health monitoring. The evolution of microelectronics and the sensor technology particularly the recent growth in MEMS (micro electromechanical systems) have led to the availability of powerful tools for health monitoring. Information about the health of the structure can be obtained at any desirable moment without any need for disassembly or costly inspection.